

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 15 FEB 2006

PCT

Applicant's or agent's file reference RSJ07980WO	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/GB2004/005230	International filing date (day/month/year) 14.12.2004	Priority date (day/month/year) 19.12.2003	
International Patent Classification (IPC) or national classification and IPC H01J37/32			
Applicant OXFORD INSTRUMENTS PLASMA TECHNOLOGY LIMITED			
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 7 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> <i>(sent to the applicant and to the International Bureau) a total of 1 sheets, as follows:</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. <p>b. <input type="checkbox"/> <i>(sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</i></p>			
<p>4. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Box No. I Basis of the opinion <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input type="checkbox"/> Box No. VIII Certain observations on the international application 			
Date of submission of the demand 15.07.2005	Date of completion of this report 16.02.2006		
Name and mailing address of the international preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Hofmann, K Telephone No. +31 70 340-2003		



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/005230

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
 - This report is based on translations from the original language into the following language, which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3 and 23.1(b))
 - publication of the international application (under Rule 12.4)
 - international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-22 as originally filed

Claims, Numbers

1-7, 9, 12-21 as originally filed
8, 10, 11 filed with telefax on 15.07.2005

Drawings, Sheets

1/6-6/6 as originally filed

a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to sequence listing (*specify*):

4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/GB2004/005230

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-21
	No:	Claims	
Inventive step (IS)	Yes:	Claims	4-6,11,12,14-16
	No:	Claims	1-3,7-10,13,17-21
Industrial applicability (IA)	Yes:	Claims	1-21
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/GB2004/005230

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following document/s:

- D1: US-A-5 766 364 (ISHIDA ET AL) 16 June 1998 (1998-06-16)
- D2: US-B1-6 569 257 (NGUYEN HUONG THANH ET AL) 27 May 2003 (2003-05-27)
- D3: US-B1-6 538 872 (WANG YOU ET AL) 25 March 2003 (2003-03-25)
- D5: US 2001/001954 A1 (URABE KOJI) 31 May 2001 (2001-05-31)

2 INDEPENDENT CLAIM 1

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 does not involve an inventive step in the sense of Article 33(3) PCT. The document D5 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document):

Plasma processing apparatus (fig.1) comprising: a chamber (100) within which a substrate (1) is processed in use (par. 38, line 5); a first electrode (10; substrate holder functions as counter electrode to upper electrode 16; it is grounded as part of the processing chamber; fig.1) formed from a nickel alloy (par. 37, line 5) having substantially planar upper (cf. fig.1, substrate holder 10) and lower (cf. fig.1 lower surface of holder 10 attached to chamber bottom) surfaces, wherein the substrate is placed for processing upon the upper surface (par. 38 and fig.1) of the first electrode (10); a second electrode (16); a heater (14) for heating at least the first electrode (par. 37, line 8) to a processing temperature (par. 38, line 9, 13); and a power supply system (implicit, since electrodes are present) arranged to cause an electrical discharge (par. 44, line 6) between the said first (10) and second electrodes (16) so as to produce the plasma (par. 39, line 3) in the chamber from one or more gases (par. 37, line 10, 12) supplied to the chamber, characterised in that: the heater (14) comprises one or more heating members (cf. members of 14 in fig.1) arranged in a substantially planar manner (see position of member 14 in fig.1), the heater and electrode forming an assembly (cf. 10 and 14; fig.1) such that the parts of the one or more heating members that are closest

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/GB2004/005230

(upper ends of heating member 14) to the said upper surface (surface where substrate 1 is positioned) of the first electrode (10), define a first plane (see fig.1, plane formed by upper ends of zig-zag line) that is separated from the upper surface by a distance Y (distance between upper ends of heating element 14 to upper surface of electrode 10; fig.1), the parts of the one or more heating members that are furthest (lower ends of heating member 14) from the said upper surface (surface where substrate 1 is positioned) of the first electrode (10), define a second plane (see fig. 1, plane formed by lower ends of zig-zag-line), wherein the separation of the first and second planes defines a heater thickness X (thickness of element 14)...

The subject-matter of claim 1 differs from this known D5 in that the distance Y lies in the range 1.2X to 3X.

The problem to be solved by the present invention may be regarded as providing optimized thermal performance between heater, substrate and substrate holder.

The solution to this problem proposed in claim 1 of the present application is not considered as involving an inventive step (Article 33(3) PCT) for the following reasons: The thermal performance (thermal conductivity, heat transfer) of the heater assembly and the substrate which is placed on the upper surface of the heater assembly is directly dependent on the dimensions of the heater and the distance between heater and substrate. Prior art shows a lot of examples (cf. D1, fig. 1; D2, fig. 2; D3, fig. 1) where a heater is embedded in a substrate holder. The skilled person would consider it a normal design procedure to find an optimized position of the heater within the assembly which provides optimized thermal performance. The range given in claim 1 is a possibility from a limited range of possibilities. It has no additional technical effect which goes beyond the optimization of the thermal performance and would be arrived by the skilled person by the application of routine experimentation (cf. Guidelines 13.03 and 13.11).

3 INDEPENDENT CLAIM 8

The present application does not meet the criteria of Article 33(1) PCT, because the subject matter of claim 8 does not involve an inventive step in the sense of Article

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/GB2004/005230

33(3)PCT.

The subject-matter of claim 8 defines a routine way of cleaning a plasma chamber (cf. e.g. D2) consisting of providing a fluorine-containing gas (D2, col.1, line 64) where said electrode (wafer support pedestal 150) is at an elevated temperature (D2, col.3, line 30) such that the chamber is cleaned by the action of the fluorine-containing gas (D2, col.6, lines 7-9).

The subject-matter of claim 8 does therefore not involve an inventive step in the sense of Art. 33(3) PCT.

4 INDEPENDENT CLAIM 19

The same objection with respect to inventive step as for the subject-matter of claim 1 applies *mutatis mutandis* to the subject-matter of independent method claim 19. The subject matter of claim 19 does therefore not involve an inventive step in the sense of Article 33(3) PCT.

5 DEPENDENT CLAIMS 2, 3, 7, 9, 10, 13, 17, 18, 20, 21

Dependent claims 2, 3, 7, 9, 10, 13, 17, 18, 20, 21 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of inventive step (Article 33(3) PCT).

D2 teaches a cleaning method according to claims 9, 10, 13, 17, 18.

D3 teaches a heating element according to claim 7.

D4 teaches the use of a heat shield according to claim 3.

D5 teaches a heater assembly according to claim 2 and a plasma processing method according to claims 20 and 21.

6 DEPENDENT CLAIMS 4-6, 11, 12, 14-16

**INTERNATIONAL PRELIMINARY
REPORT ON PATENTABILITY
(SEPARATE SHEET)**

International application No.

PCT/GB2004/005230

The combination of the features of dependent claims 4-6, 11, 12, 14-16 are neither known from, nor rendered obvious by, the available prior art.

first electrode is at an elevated temperature such that the first electrode is cleaned by the action of the fluorine-containing gas.

9. A method according to claim 8, wherein the method 5 comprises, prior to the introduction of the gas, using the chamber to perform plasma processing upon a substrate heated to a processing temperature.

10. A method according to claim 8 or claim 9, wherein the first electrode is maintained at a predetermined 10 temperature during cleaning.

11. A method according to claim 8 or claim 9, wherein the first electrode is allowed to cool during cleaning.

12. A method according to any of claims 8 to 11, wherein the elevated temperature is at least initially at 15 substantially the processing temperature.

13. A method according to any of claims 8 to 12, wherein the elevated temperature is in the range 200°C to 800°C.

14. A method according to claim 13, wherein the temperature is in the range 400°C to 700°C.

20 15. A method according to any of claims 8 to 14, wherein the fluorine-containing gas comprises a mixture of CF₄ and O₂ in the respective ratios of 80% to 20% by volume.

16. A method according to any of claims 8 to 15, wherein the flow rate of the fluorine-containing gas is 150 25 standard cubic centimetres per minute.

17. A method according to any of claims 8 to 16, wherein the plasma cleaning step is performed using a low frequency component of between 50kHz and 450 kHz, and/or high frequency component of 13.56 MHz.